

WHAT IS CLAIMED IS:

1. A method of forming a pattern comprising:

coating a photosensitive resist film on a surface  
of substrate;

5       subjecting said photosensitive resist film to an  
exposure process;

coating an oxidizing liquid having an oxidative  
effect on a surface of said photosensitive resist film  
that has been subjected to said exposure process to  
10       thereby perform a pretreatment wherein the surface of  
said resist film is caused to oxidize by said oxidizing  
liquid to form an oxide layer thereon;

feeding a developing solution to said photo-  
sensitive resist film whose surface has been oxidized  
15       to thereby perform a development of said resist film;  
and

feeding a rinsing solution to a surface of said  
substrate to wash said substrate.

2. The method according to claim 1, wherein said  
20       pretreatment is performed until contact angles of said  
developing solution and said rinsing liquid to said  
photosensitive resist film are decreased.

3. The method according to claim 1, wherein said  
oxidizing liquid is an aqueous solution containing at  
25       least one kind of material selected from the group  
consisting of ozone, oxygen, carbon monoxide and  
hydrogen peroxide.

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4. The method according to claim 1, wherein said pretreatment is performed in a manner that said oxide layer formed does not extend not larger than 5 nm in depth-wise direction of said resist film.

5 5. The method according to claim 4, wherein said oxidizing liquid is an aqueous solution of ozone 5 ppm or less in concentration of ozone.

10075619-021502 6. The method according to claim 1, wherein said pretreatment is performed in a manner that the surface of said photosensitive resist film is oxidized to form said oxide layer without causing the decomposition of a polymer constituting said resist film.

15 7. The method according to claim 1, wherein said pretreatment is performed in a manner that an invaded layer where a polymer constituting said resist film within said oxide layer is decomposed by said oxidizing liquid is permitted to extend less than 5 nm in depth-wise direction of said resist film; and said developing solution is allowed to impregnate into said invaded layer on the occasion of feeding said developing solution over the surface of said photosensitive resist film, thereby forming a swelled layer, which is subsequently peeled off by feeding said rinsing liquid to the surface of said substrate.

25 8. The method according to claim 1, feeding a developing solution to said photosensitive resist film is performed in a manner wherein said developing

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5 solution is ejected from a developing solution-ejecting nozzle to the surface of said photosensitive resist film, and concurrently, said substrate is moved relative to said developing solution-ejecting nozzle to thereby form a film of said developing solution.

9. The method according to claim 1, wherein the oxidizing liquid which has been fed to the surface of said photosensitive resist film is removed, and the surface of said substrate is permitted to dry.

10 10. The method according to claim 1, wherein a liquid layer consisting of oxidizing liquid which has been coated is made into a thin film; and the film of said developing solution is formed under a condition where said liquid layer has been made into said thin film.

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11. The method according to claim 1, wherein following the formation of said film of developing solution, said film of developing solution is agitated.

12. A method of disposing a chemical liquid comprising:

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feeding an alkaline solution to a chemical liquid-retaining portion which is disposed outside a substrate having a thin film formed on a main surface thereof;

25 feeding an aqueous solution of ozone to a main surface of said substrate to thereby reform a surface of said thin film, said aqueous solution of ozone which has been employed in the reforming being subsequently

introduced into said chemical liquid-retaining portion where said alkaline solution is retained;

decomposing ozone of said aqueous solution of ozone that has been introduced into said chemical liquid-retaining portion by making use of said alkaline solution retained in said chemical liquid-retaining portion; and

discharging said alkaline solution and said aqueous solution of ozone where ozone has been decomposed from said chemical liquid-retaining portion.

13. A method of forming a pattern comprising:

feeding an alkaline solution to a chemical liquid-retaining portion which is disposed outside a substrate having a thin film formed on a main surface thereof;

feeding an aqueous solution of ozone to a main surface of said substrate to thereby reform a surface of said thin film, said aqueous solution of ozone which has been employed in the reforming being subsequently introduced into said chemical liquid-retaining portion where said alkaline solution is retained;

decomposing ozone of said aqueous solution of ozone that has been introduced into said chemical liquid-retaining portion by making use of said alkaline solution retained in said chemical liquid-retaining portion;

feeding an alkaline solution to the main surface of said substrate which has been surface-modified to

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thereby selectively etch said thin film by making use of said alkaline solution, said alkaline solution employed in said etching being subsequently retained in said chemical liquid-retaining portion; and

5           discharging said alkaline solution and said aqueous solution of ozone where ozone has been decomposed from said chemical liquid-retaining portion.

14. A method of forming a pattern comprising:

10           feeding an alkaline solution to a main surface of a substrate having a thin film formed on a main surface thereof to thereby selectively etch said thin film by making use of said alkaline solution;

15           retaining said alkaline solution which has been employed for said etching in a chemical liquid-retaining portion disposed outside said substrate;

20           feeding an aqueous solution of ozone to a main surface of said substrate which has been etched to thereby wash the main surface of said substrate, said aqueous solution of ozone which has been employed in the washing being subsequently introduced into said chemical liquid-retaining portion;

25           decomposing ozone of said aqueous solution of ozone that has been introduced into said chemical liquid-retaining portion by making use of said alkaline solution retained in said chemical liquid-retaining portion;

          drying said substrate which has been washed; and

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discharging said alkaline solution and said aqueous solution of ozone where ozone has been decomposed from said chemical liquid-retaining portion.

15. A method of forming a pattern comprising:

5       feeding an alkaline solution to a chemical liquid-retaining portion which is disposed outside a substrate having a thin film formed on a main surface thereof;

10       feeding an aqueous solution of ozone to a main surface of said substrate to thereby reform a surface of said thin film, said aqueous solution of ozone which has been employed in the reforming being subsequently introduced into said chemical liquid-retaining portion where said alkaline solution is retained;

15       feeding an alkaline solution to the main surface of said substrate where said thin film has been reformed to thereby selectively etch said thin film by making use of said alkaline solution, said alkaline solution employed in said etching being subsequently retained in said chemical liquid-retaining portion;

20       exposing the main surface of said substrate where said thin film has been etched to said aqueous solution of ozone to thereby wash the main surface of said substrate, said aqueous solution of ozone which has been employed in said washing being subsequently introduced into said chemical liquid-retaining portion;

25       decomposing ozone of said aqueous solution of ozone that has been introduced into said chemical

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liquid-retaining portion by making use of said alkaline solution retained in said chemical liquid-retaining portion;

- 5       drying said substrate which has been dried; and  
      discharging said alkaline solution and said aqueous solution of ozone where ozone has been decomposed from said chemical liquid-retaining portion.

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